

**PERFORMANCE TEST RESULTS FOR A 25 K SORPTION
CRYOCOOLER DESIGNED FOR THE UCSB LONG
DURATION BALLOON COSMIC MICROWAVE
BACKGROUND RADIATION EXPERIMENT**

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A continuous operation vibration-free, long-life 25 K sorption cryocooler has been built and is now in final performance testing. This cooler will be flown on the University of California at Santa Barbara (UCSB) Long Duration Balloon (LDB) cosmic microwave background radiation experiment. The UCSB LDB experiment will be flown at Antarctica in December 1996. The cooler will refrigerate a focal plane composed of four microwave feedhorns, two working at 30 and two at 42 GHz, with InP High Electron Mobility Transistor (HEMT) amplifiers. This will be the first hydride sorption cooler used to support an astrophysics experiment. As such it is an important milestone in the development of vibration-free coolers for astrophysics applications.

The cooler uses hydrogen as the refrigerant and $\text{LaNi}_{4.8}\text{Sn}_{0.2}$ as the hydride sorbent. The materials, components, design margins and assembly procedures are entirely consistent with space-flight qualification requirements. Several features, including a high pressure tank and low pressure sorbent bed, are incorporated to stabilize the cold temperature to better than 1 mK/sec. Small ZrNi compressors are utilized to activate the compressor element gas-gap thermal switches without valves. Porous plugs are used as the Joule-Thomson flow restrictor to greatly enhance contamination tolerance. Passive check valves are used to direct the refrigerant flow. A design description and parametric test results are presented, which detail the effectiveness of the temperature stabilization methods and the cooler operating characteristics.

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